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New records of bats (Mammalia: Chiroptera) for a southern locality of the Argentine Yungas

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Abstract: The forests of northwestern Argentina represent one of the most diverse areas of the country, but also one of the most affected by human activities. The southern border of this region is a transition area with the Dry Chaco Ecoregion and represents a poorly studied zone. The aim of this study was to assess the diversity of bats at the village of Escaba, southern Tucuman. Seven field surveys were conducted at five different sites. A total of 120 specimens in three families and 14 species were recorded, 12 of them representing new records for the study area, increasing the species richness of Escaba from four to 16 species. The area will be recommended as an AICOM, a status given by the RELCOM, thereby promoting actions to preserve the species of bat in the area.

Key words: Argentina; diversity; species richness; Tucuman

INTRODUCTION

The forests of northwestern Argentina belong to the Amazonic Domain of the Neotropical Region (Cabrera 1976) and are considered as one of the richest and most diverse areas in the world (Mittermeier et al. 1999). This is the third most diverse area for bats in Argentina, containing 66% of the 65 species in the country (Díaz et al. 2016), and is an important area for two reasons: species richness and the high level of degradation (Barquez & Díaz 2001; Díaz & Barquez 2007; Jayat et al. 2009; Jayat & Ortiz 2010). In the past few years, several species of bats have been added to the fauna of Argentina as well as to the Yungas Forests (Barquez et al. 2009; Díaz & Barquez 2009; Barquez et al. 2011). However, the knowledge of important aspects of this group such as reproduction patterns, feeding habits, ecology, and natural history is still scarce and more effort and intensive studies should be carried out (Barquez & Díaz 2001).

The southernmost area of the Yungas ecoregion, a transitional area with the Dry Chaco ecoregion, is one of the least studied areas and it is under enormous pressure from human activities such as agriculture and tourism. The village of Escaba, Tucuman province, northwestern Argentina, is located within this area. When this study began, only four species of bats were known for Escaba: *Chrotopterus auritus* (Phyllostomidae), *Myotis dinellii* (Vespertilionidae), *Promops nasutus*, and *Tadarida brasiliensis* (Molossidae) (Barquez et al. 1999; Barquez & Díaz 2001). The aim of the study was to assess the current diversity of bats in the area.

MATERIALS AND METHODS

Study site

The village of Escaba (27°66′ S, 065°76′ W) is located 25 km southwest of Alberdi City, Tucuman province, Argentina (Figure 1). The area belongs to the Yungas ecoregion (Burkart et al. 1999) and corresponds to the Transition Forests District (Cabrera 1976), which extends up to 500 m elevation. The area is represented by plant species such as *Prosopis alba*, *P. nigra*, *Anadenanthera colubrina*, and *Eugenia uniflora* (Pantorrilla & Nuñez Regueiro 2006). The study locality includes areas disturbed by livestock, deforestation associated with agriculture and extraction of timber and other resources for local consumption. There are also undisturbed zones where vegetation is better preserved due to the absence of human activity.

Data Collection

The specimens were collected at five different sites (Figure 1), during seven field surveys of three nights each, between September 2012 and October 2015. The bats were captured using six 12 m mist nets set at ground and after sunset inside forest, over streams or rivers, and near abandoned buildings, roads and culverts. Nets were kept open for six-hour periods. The sampling effort was calculated following Medellín (1993) using length of mist nets, in meters, and hours (m-hours) for each night. In the field, external mea-

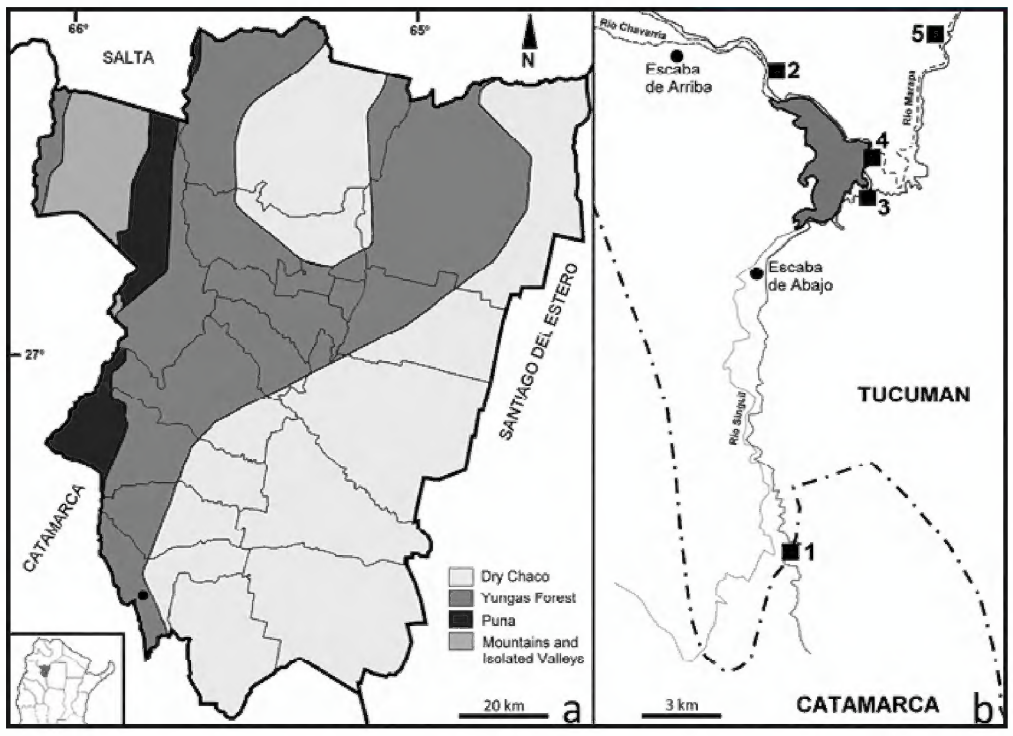

Figure 1. a. Location of Escaba (black dot) in Juan Bautista Alberdi Department, southern Tucuman Province, Argentina. **b.** Collection sites in the study area; for details see Table 2.

surements, age, sex, body mass, and reproductive condition were recorded for each captured specimen following Díaz et al. (1998). Species were identified following Barquez & Díaz (2009) and Díaz et al. (2011). Bats were grouped by trophic guilds using information from Aguirre (2002) and Segura-Trujillo et al. (2016). Voucher specimens were prepared as skins, skulls, and skeletons, or preserved in alcohol (Díaz et al. 1998). The collecting of specimens was authorized through collection permits (No. 213-13) issued by the Dirección de Flora, Fauna y Suelos, Tucuman province. The voucher specimens are deposited at the Colección Mamíferos Lillo (CML), Universidad Nacional de Tucumán, Argentina.

RESULTS

Fieldwork was conducted for 21 nights with a sampling effort of 9,072 m-hours, resulting in the capture of 120 specimens in 14 species and three families (Table 1). The best represented family was Vespertilionidae with 10 species (71.4% of total species), followed by Phyllostomidae with three (21.4%), and Molossidae with one (7.2%). The most abundant species was *Myotis dinellii* with 50 captured specimens (41.7% of total captures), followed by *Sturnira lilium* with 22 (18.5%).

The species recorded in the study area are detailed below under Species Accounts, where we indicate the number of specimens examined, and provides brief remarks about reproductive condition and natural history of the species. We also provide a short diagnosis for uncommon species.

Table 1. List of species of bats from Escaba, Tucuman, Argentina, with the number of specimens examined (*n*), sex and age, collecting sites (see Table 2) and trophic guilds. Abbreviations: SA, subadult; IND, sex and age undetermined; A, adult; San, Sanguivorous; Fru, frugivorous; FF-Ins, fast-flying insectivorous; SF-Ins, slow-flying insectivorous.

Species	*n*	Material examined	Site	Guild
Family Phyllostomidae				
Desmodus rotundus	10	CML 10826 (♂SA), 10827 (♂SA); 8 released (1♂SA, 5♂A, 2♂)	1, 2, 3	San
Sturnira erythromos	5	CML 10822 (♀SA), 10823 (♀A); 3 released (1♀A, 2♂A)	1, 2, 3	Fru
Sturnira lilium	22	CML 10824 (♀A) , 10825 (♀A); 20 released (5♀A, 1♂SA, 14♂A)	3, 5	Fru
Family Molossidae				
Tadarida brasiliensis	5	CML 10849 (♂A), 10851 (♂SA), 10852 (♀A); 2 released (2♀A)	3, 4	FF-Ins
Family Vespertilionidae				
Dasypterus ega	1	CML 10828 (♀A)	4	FF-Ins
Eptesicus diminutus	1	CML 10829 (♂)	3	SF-Ins
Eptesicus furinalis	4	CML 10830 (♀A), 10831 (♀A), 10832 (♀A); 1 released (♂A)	1, 3	SF-Ins
Histiotus laephotis	1	CML 10833 (♂SA)	1	SF-Ins
Histiotus macrotus	8	CML 10834 (♀A), 10835 (♀A), 10836 (♂A); 5 released (4♀A, 1♂A)	1, 3	SF-Ins
Lasiurus blossevillii	4	CML 10837 (♂A), 10838 (♀A); 2 released (1♀A, 1♂A)	1, 5	FF-Ins
Myotis albescens	2	CML 10839 (♂A); 1 released (♂A)	3	SF-Ins
Myotis dinellii	50	CML 10840 (♀A), 10841 (♀A), 10842 (♂A), 10843 (♀A), 10844 (♀A), 10845 (♀SA); 44 released (1♀SA, 31♀A, 11♂A, 1UND)	1, 3, 5	SF-Ins
Myotis keaysi	1	CML 10846 (♀A)	5	SF-Ins
Myotis riparius	6	CML 10847 (♂A), 10848 (♂A); 4 released (3♀A, 1♂A)	1, 5	SF-Ins

Table 2. Collecting sites; site numbers correspond to the map, Figure 1.

Site	Province	Site	Latitude (S)	Longitude (W)	Elevation (m a.s.l.)
1	Catamarca	22 km SE Villa de Escaba, por ruta provincial 9	27°47′48.48″ S	065°46′56.70″ W	538
2	Tucuman	6 km NW Villa de Escaba	27°38′06.87″ S	065°47′28.9″ W	664
3	Tucuman	Escaba de Abajo, hostería Eskay Apu	27°40′11.7″ S	065°45′45.5″ W	684
4	Tucuman	Escaba, sobre puente del Dique Escaba	27°39′29.34″ S	065°45′47.52″ W	619
5	Tucuman	Villa de Batiruana	27°38′11.61″ S	065°44′40.29″ W	515

Species accounts

Family Phyllostomidae

Desmodus rotundus (É. Geoffroy St.-Hilaire, 1810)

Phyllostoma rotundum É. Geoffroy St.-Hilaire (1810): 181. — Barquez et al. (1999): 78; Kwon & Gardner (2008): 220.

Desmodus rotundus — Thomas (1900): 546; first use of current name combination.

Material examined. 10 specimens, see Table 1.

All specimens were males. Three were subadults, two from September and one from December. One adult with abdominal testes was captured in January, and four adults with scrotal testes were collected, one in January and three in February. The specimens were collected near the ground and always in areas with livestock.

Sturnira erythromos (Tschudi, 1844)

Ph(yllostoma) erythromos Tschudi (1844): 64. — Barquez et al. (1999): 46; Gardner (2008): 367.

Sturnira erythromos — de la Torre (1961): 124; first use of current name combination.

Material examined. 5 specimens, see Table 1.

All but one specimen were adults and collected inside forest. A female with open vagina was captured in December; two females with closed vagina were captured in January and in March. A male with subscrotal testes was found in March and another with abdominal testes in October.

Sturnira lilium (É. Geoffroy St.-Hilaire, 1810)

Phyllostoma lilium É. Geoffroy St.-Hilaire (1810): 181. — Barquez et al. (1999): 50; Gardner (2008): 370.

Sturnira lilium — Gervais (1856): 39; first use of current name combination.

Material examined. 22 specimens, see Table 1.

In February, six adult females (one with closed vagina and five with open vagina) and seven adult males (one with scrotal testes and six with abdominal testes) were captured. In October, one adult female with open vagina and eight males, seven with abdominal testes, were registered. All specimens were captured in forest near an abandoned house.

Family Molossidae

Tadarida brasiliensis (I. Geoffroy St.-Hilaire, 1824)

Nyctinomus brasiliensis I. Geoffroy St.-Hilaire (1824): 343. — Barquez et al. (1999): 178; Eger (2008): 438.

Tadarida brasiliensis — Thomas (1920b): 222; first use of current name combination.

Material examined. 5 specimens, see Table 1.

Two males with abdominal testes, one adult and one subadult, were captured in March and October, respectively. The adult male was collected on the bridge of the Escaba Dam, whereas the subadult was captured while flying above the river. In October, three adult females, two with open vagina and one with closed vagina, were captured above the river. The Escaba Dam has become very popular among locals and tourists in recent years due to the presence of a large colony of *T. brasiliensis*, estimated at 12 million individuals, recognized as the largest colony occupying a man-made construction (Barquez, unpublished data). However, the colony suffered a major decline in 2003 due to significant changes in the dam that affected their shelters (Regidor et al. 2003). The population has not recovered its abundance until today (S. Gamboa Alurralde, unpublished data).

Family Vespertilionidae

Dasypterus ega (Gervais, 1856)

Nycticeius ega Gervais (1856): 77 — Barquez et al. (1999): 143; Gardner & Handley (2008): 465.

Dasypterus ega— Allen 1894: 138; first use of current name combination.

Material examined. 1 specimen, see Table 1.

Contrary to Simmons (2005) and Gardner & Handley (2008), several authors have supported the recognition of *Dasypterus* as a valid genus (Barquez et al. 1999; Baird et al. 2015). A lactating female with open vagina was captured in March on the bridge of the Escaba Dam very near the entrance of the colony of *Tadarida* inside the dam.

Eptesicus diminutus Osgood, 1915

Eptesicus diminutus Osgood (1915): 197 — Barquez et al. (1999): 120; Davis & Gardner (2008): 446.

Material examined. 1 specimen, see Table 1.

In November, a male with abdominal testes was captured near an abandoned house. This is a rare species for the Yungas Forests (Barquez & Díaz 2001), and was known from only three previous records from the northern part of Tucuman province in two departments (Burruyacú and Tafí Viejo). This specimen represents the southernmost record for the species in Tucuman, and the provincial distribution limit is extended 128 km south from the previous recorded localities (Barquez et al. 1999). Since this species is also known from Catamarca province, located south of Tucuman, this record fills a gap in the distribution of *E. diminutus*.

Eptesicus furinalis (d'Orbigny & Gervais, 1847)

Vespertilio furinalis d'Orbigny & Gervais (1847): 13 — Barquez et al. (1999): 123; Davis & Gardner (2008): 447.

Eptesicus furinalis — Thomas (1920a): 365; first use of current name combination.

Material examined. 4 specimens, see Table 1

All specimens were adults, captured in forest. Three females with closed vagina were captured in January and March, and one male with scrotal testes was collected in January. This is a common species widely distributed throughout the country in several ecoregions (Barquez et al. 1999).

Histiotus laephotis Thomas, 1916

Histiotus laephotis Thomas (1916): 275 — Barquez et al. (1999): 129; Handley & Gardner (2008): 455.

Material examined. 1 specimen, Figure 2, Table 1.

Figure 2. a. *Histiotus laephotis*. **b.** *Histiotus macrotus*. Photos by SGA.

This is a medium-sized bat with large pale ears, generally greater than 30 mm, and connected by an obvious membranous band (3 mm) (Díaz et al. 2016). Dorsal coloration is light brown, with little contrast between the bases and tips of the hairs. Although robust, the skull is not as broad as in *H. macrotus* and the external breadth across the third upper molars is less than 7 mm (Barquez et al. 1999). One subadult male with abdominal testes was captured in October inside forest. Because this species is difficult to capture with mist nets, individuals are rare in collections.

Histiotus macrotus (Poeppig, 1835)

Nycticeius macrotus Poeppig (1835): 451 — Barquez et al. (1999): 129; Handley & Gardner (2008): 451.

Histiotus macrotus — Peters (1876): 788; first use of current name combination.

Material examined. 8 specimens, Figure 2, Table 1.

This species has large dark ears, longer than 30 mm, with a membranous band narrower than in *H. laephotis* (2 mm) (Díaz et al. 2016). The dorsal hairs are strongly bicolored, with black or dark brown bases and yellow tips. The skull is robust, with wide rostrum, and the external breadth across the third upper molar is greater than 7 mm (Barquez et al. 1999). Six adult females, five with closed vaginas and one with open vagina, were captured in September and October respectively. Two adult males with abdominal testes were captured in November. This species is difficult to capture with mist nets. *Histiotus macrotus*, as well as *Lasiurus blossevillii* and *Myotis riparius*, were collected in a culvert under the road.

Lasiurus blossevillii (Lesson, 1826)

Vespertilio blossevillii Lesson (1826): 95 — Barquez et al. (1999): 146; Gardner & Handley (2008): 460.

Lasiurus blossevillii — Baker et al. (1988): 8; first use of current name combination.

Material examined. 4 specimens, see Table 1.

Two males with abdominal testes and two females with open vagina were captured in September and October in mist nets along a stream. The specimens of this species and others of the genera *Histiotus* and *Myotis* were captured at one end of a culvert under a road. This could mean that these species were sharing the feeding area. These records are important because these species are very difficult to capture with mist nets.

Myotis albescens (É. Geoffroy St.-Hilaire, 1806)

Vespertilio albescens É. Geoffroy St.-Hilaire (1806): 204 — Barquez et al. (1999): 90; Wilson (2008): 471.

Myotis albescens — Thomas (1900): 546; first use of current name combination.

Material examined. 2 specimens, Figure 3, Table 1.

This is a small bat with a soft and dense pelage and many of its dorsal hairs have white tips, giving a silvery or frosted appearance. The venter is light colored, almost pure white on the abdomen. The feet are robust and rounded, similar to those of molossids. The braincase is globose, the rostrum short, and the postorbital constriction wide, generally greater than 4 mm (Barquez et al. 1999). Two adult males, one with scrotal testes and one with abdominal testes, were captured in March. They were roosting in an abandoned house together with a small group of *Myotis dinellii* and some specimens of *T. brasiliensis*. In other studies *Myotis albescens* was recorded sharing roosts with other bats, including *Rhynchonycteris naso* (Emballonuridae), *Eptesicus furinalis*, *Myotis nigricans* (Vespertilionidae), *Molossus sinaloae*, *Molossops*, *Eumops*, and *Tadarida* (Molossidae) (Braun et al. 2009; Díaz & Linares García 2012).

Myotis dinellii Thomas, 1902

Myotis dinellii Thomas (1902): 493; first use of current name combination — Barquez (2006): 100; Miranda et al. (2013): 513.

Material examined. 50 specimens, Figure 3, Table 1.

Dorsal hairs are bicolored, with the bases very dark brown or black; tips are lighter, generally yellow. Rostrum and ears are black in strong contrast with the body coloration (Díaz et al. 2016). Ventrally, the bases of hairs are almost black, but the tips are cream, not white as in *M.*

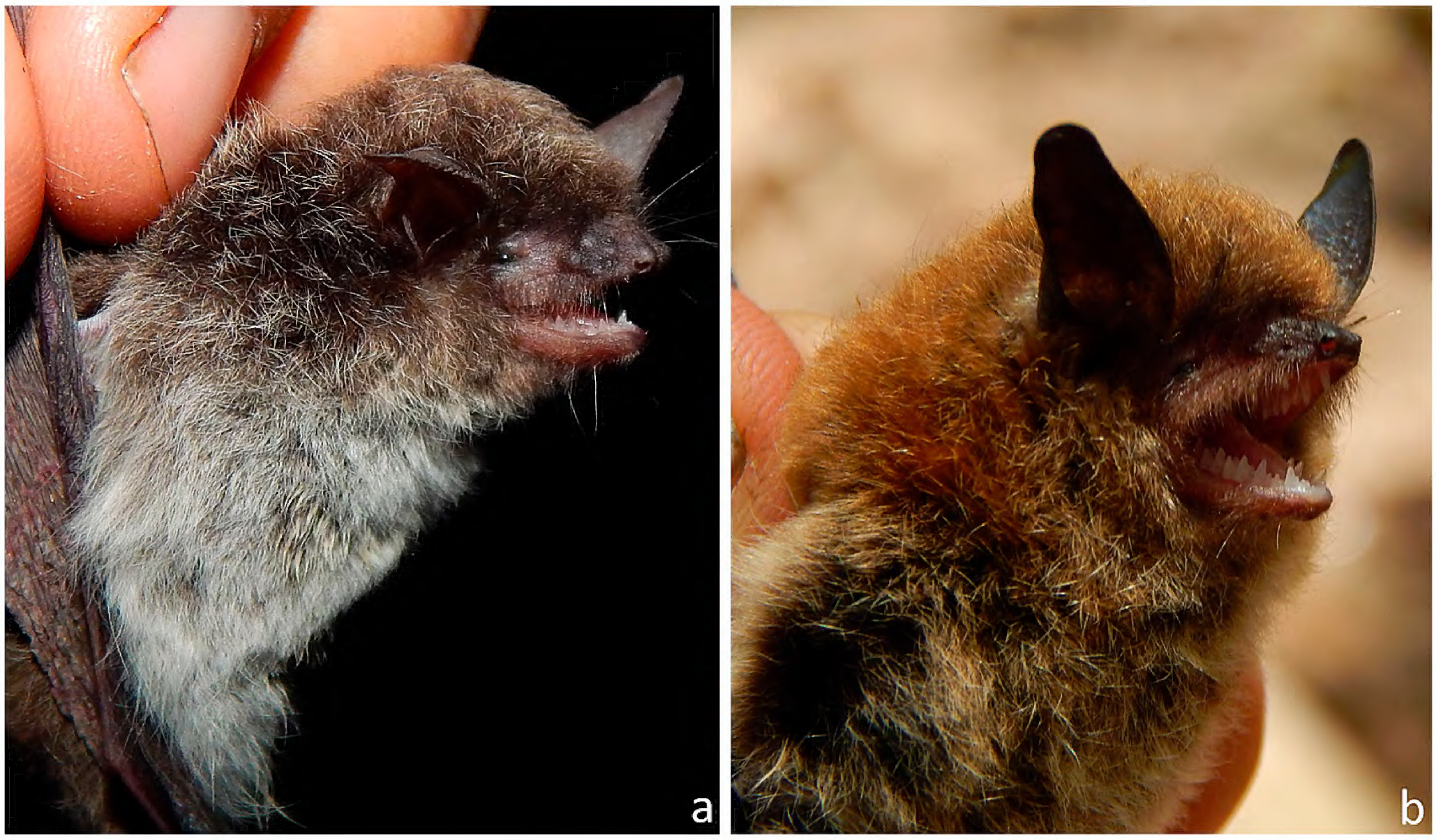

Figure 3. a. *Myotis albescens*. **b.** *Myotis dinellii*. Photos by SGA.

albescens. The feet are small and not rounded. The skull is quite robust, the rostrum elongated, and the postorbital constriction narrow, generally less than 4 mm (Barquez et al. 1999). This was the most abundant species recorded and most of the specimens were collected near the same abandoned house as *M. albescens*. With the exception of two subadults, collected in March and September, all specimens captured were adults. Twelve of them were males, one with scrotal testes, captured in March, and 11 with abdominal testes, captured in January (3), March (2), and October (5). Thirty-seven females were captured, 19 with open vagina captured in January (1), February (8), and March (10); and 18 showed closed vagina, captured in January (2), February (1), March (6), and October (9). In the building a barn owl (*Tyto alba*) and its pellets were found. Skulls of *Myotis* were found in the pellets.

Myotis keaysi Allen, 1914

Myotis ruber keaysi Allen (1914): 383 — Barquez et al. (1999): 99; Wilson (2008): 474.

Myotis keaysi— LaVal (1973): 22; first use of current name combination.

Material examined. 1 specimen, see Table 1.

This is a large species of *Myotis* in Argentina, with a forearm greater than 40 mm. The pelage extends over at least one-third of the uropatagium and over the knee. Overall color is dark brown with the dorsal hairs lightly bicolored, their bases darker than the tips. The skull is small, with a weakly developed sagittal crest (Barquez et al. 1999). Little is known about the biology of this species, with few records in Tucuman and the Yungas Forests (Barquez et al. 1999). An adult female with closed vagina was captured in October in a mist net placed over a river. According to LaVal (1973), this species occurs above 1000 m, but we recorded it at 515 m.

Myotis riparius Handley, 1960

Myotis simus riparius Handley (1960): 466 — Barquez et al. (1999): 110; Wilson (2008): 478.

Myotis riparius — LaVal (1973): 32; first use of current name combination.

Material examined. 6 specimens, see Table 1.

Dorsal coloration of this species is cinnamon brown with the base of the hairs dark brown. The tips of many of the hairs are bright yellow, giving a frosted appearance, although this is less pronounced than in *M. albescens*. The skull has a low sagittal crest and the postorbital constriction is narrow, generally less than 4 mm. In most specimens, the small P2 is displaced to the lingual side of the toothrow, and it is not visible in lateral view (Barquez et al. 1999). Three adult males were captured, one with scrotal testes in September and two with abdominal testes in January and October. Three adult females were collected, two with open vagina in September and one with closed vagina in October. Five of these specimens were captured over a stream close to the culvert where *Lasiurus blossevillii* and *Histiotus* spp. were collected.

DISCUSSION

All the species recorded at Escaba during this study, with the exception of two (*Myotis dinellii* and *Tadarida brasil-*

iensis) represent new distributional records for the area, increasing the known bat species diversity from four to 16 species.

Our records include 11 insectivorous species (78.6%), two frugivorous (14.3%), and one sanguivorous (7.1%). The most abundant was *M. dinellii*, a species that is common in the forests of northwestern Argentina. Although the capture of large numbers of individuals of this species is unusual, the recorded abundance is likely because the mist nets were placed at strategic points, after we discovered a small colony sheltered within an abandoned house. In other studies in Argentina, this species was also found roosting inside buildings (López Berrizbeitia & Díaz 2013; Lutz 2013). The high abundance of *Sturnira lilium* is also coincident with other several studies made in tropical (Kalko & Handley 2001) and subtropical environments (Moya et al. 2008; Gamboa Alurralde et al. 2016), where bat assemblages are dominated by frugivorous species. Although most species of bats are insectivorous (Shiel et al. 1997), in tropical environments they are usually not the dominant guild, whereas at higher latitudes the importance of insectivores in the structure of bat communities increases, as recorded in this study.

Species richness in the study area, after 21 nights of sampling, is high compared with other studies in the Yungas Forests of the surrounding provinces. Bracamonte (2010) recorded nine species after 19 nights of sampling in a montane forest in Jujuy, one of the provinces with the greatest diversity of bats in Argentina.

The community is also well represented compared with results from Sánchez (2011) who, with an effort of 12,422 m-hours, reported an assemblage of 14 species in a Yungas Forests locality in Catamarca province. In this study, we also registered 14 species but with less effort, so the community is well represented. Moreover, we highlight the presence of rare species such as *Eptesicus diminutus*, *Histiotus laephotis*, *H. macrotus*, and *Myotis keaysi*, because the knowledge of their biology is very limited. All the species recorded in this study share the Yungas and Dry Chaco ecoregions. However, some species are more closely related to one or the other ecoregion. For example, almost all the records of *Myotis keaysi* are from the Yungas, but those of *Promops nasutus* are associated mostly with the Chaco. In this sense, it is important to mention that *P. nasutus* was not collected in the Yungas natural vegetation, but in abandoned human constructions, located in open areas in a transitional zone. One species previously recorded at Escaba (*Chrotopteus auritus*) was captured in a mist net placed at the exit of the colony of *Tadarida brasiliensis* that inhabits the dam. It is possible that this specimen was feeding opportunistically on the *Tadarida*, while they were leaving the colony (Barquez & Díaz 2001). This record along with another from La Cocha (Tucuman province), represent two of the southernmost known records for this species.

Barquez & Díaz (2009) registered 29 bat species in the province of Tucuman, but *Nyctinomops laticaudatus* was erroneously included; thus, the actual number of bat species in the province is 28. The locality of this study contains a high diversity, representing 57% of all bat species in the province. However, it is important to mention that several species, such as *Sturnira oporaphilum*, *Artibeus planirostris*, and *Eumops glaucinus*, which have already been registered in other localities in the southern part of the Yungas Forests, are probably present in Escaba, although they have not yet been reported in this zone.

More surveys are necessary in the area in order to determine more precisely the structure of the bat community (e.g., habitat use, diet, foraging behavior, and roost selection), and also to obtain a better knowledge of the ecology of the bats. On the other hand, the study locality is extremely important because of its location in the southernmost limits of the Yungas ecoregion, which is a transition area with the Dry Chaco ecoregion. Despite this, long-term studies have been scarce in the area, while habitat fragmentation and degradation have reached critical levels. In order to help the preservation of the area and the huge colony of *Tadarida brasiliensis*, the Escaba Dam was recognized in 2013 as a Site of Importance for the Conservation of Bats (SICOM), and based on the diversity recorded in this study the Escaba area will be proposed as an AICOM (Área de Importancia para la Conservación de Murciélagos; in English, Important Area for Bats Conservation), a status awarded by the Latin American and Caribbean Bat Conservation Network (RELCOM). These designations would allow us to design and develop management plans to contribute to the conservation of the area.

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